Project Introduction

The UCDS process is the result of 50 years of research into combustion instability by the worlds leading scientists and engineers. The breakthroughs that created UCDS have provided a solid analytical foundation upon which tools can be developed and applied. One of these is the UCDS nonlinear tool, which GTL has been applying with much success in the investigations of the dynamics of solid rockets, liquid rockets and turbojets. In the proposed effort, GTL shall enhance this tool in preparation for its application to scramjets and ramjets by incorporating mean flow effects in the acoustic models used in the nonlinear algorithms. Since the Nonlinear Data Analysis Tool (NDAT) shares the same nonlinear algorithm with the UCDS nonlinear tool, this enhancement shall also improve the ability of NDAT to transform nonlinear test data into linear parameters. Taking this to the next step, GTL shall increase the functionality of NDAT by implementing changes to the algorithm that allow it to utilize the data from multiple pressure transducers in the data analysis rather than restricting the tool to the current single data channel. This will be accomplished by developing algorithm routines that use the relative location of the pressure transducers and the intervening acoustic environment to account for the temporal and phase relationships between the data streams. When implemented, these changes will allow NDAT to automatically identify the orientation of the oscillating modes and reduce the nonlinear pressure oscillation data into a clear and concise set of linear parameters. The last part of the Phase I effort will be to examine the role of nonlinear energy dissipation in scramjets in preparation for further refinement in the Phase II effort.

Primary U.S. Work Locations and Key Partners

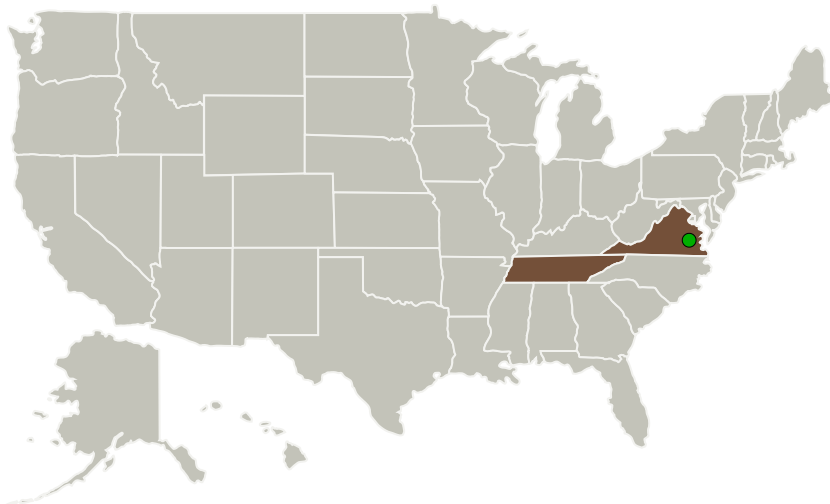Nonlinear Data Analysis Tool for Scramjets and Other Engines, Phase I

Table of Contents

Organizations Performing Work	Role	Type	Location
Gloyer-Taylor Laboratories LLC	Lead Organization	Industry	Tullahoma, Tennessee
🟢Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Tennessee	Virginia

Project Transitions

▶ **February 2012:** Project Start

✔ **August 2012:** Closed out

Closeout Documentation:
- Final Summary Chart*(https://techport.nasa.gov/file/138367)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Gloyer-Taylor Laboratories LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Eric Jacob

Co-Investigator:

Eric Jacob

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**

1	2	3	4	5	6	7	8	9

Applied Research	Development	Demo & Test

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  └ TX15.1 Aerosciences
    └ TX15.1.3 Aeroelasticity

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System